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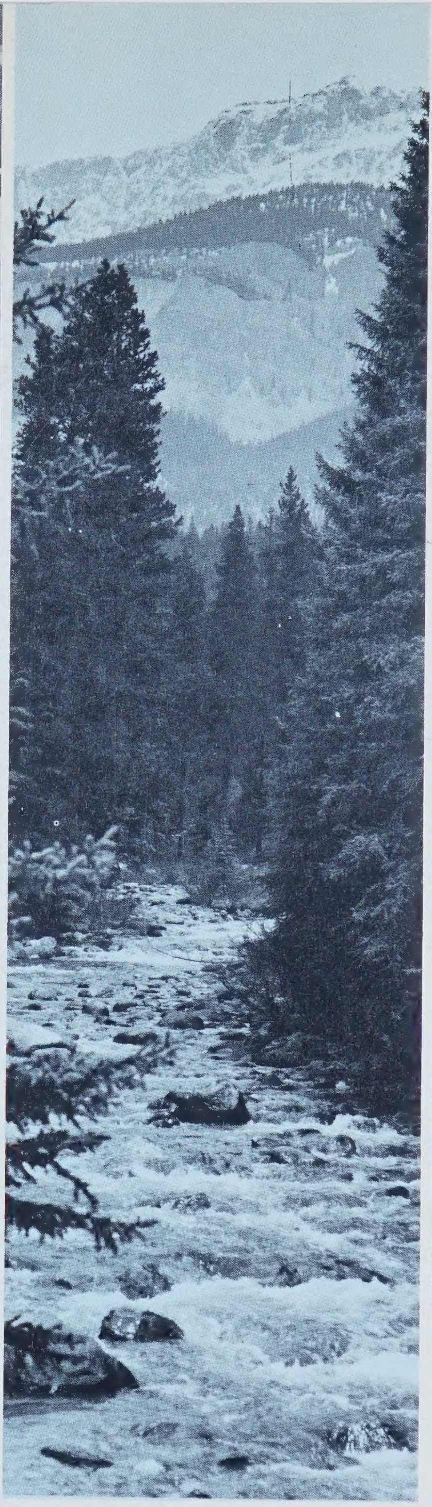

alberta department of the environment

HON. W. J. YURKO, MINISTER
DR. E. E. BALLANTYNE, DEPUTY MINISTER

WATER USE CHARGES

WATER RESOURCES
DIVISION

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WATER USE CHARGES

PREPARED BY

CENTRAL PLANNING GROUP

WATER RESOURCES DIVISION

ALBERTA DEPARTMENT OF THE ENVIRONMENT

EDMONTON, ALBERTA JULY, 1972

WATER USE CHARGES

ALBERTA

DEPARTMENT OF THE ENVIRONMENT
OFFICE OF THE MINISTER
LEGISLATIVE BUILDING
EDMONTON

Government of Alberta

POSITION PAPER

on

Water Management

The Government of Alberta considers that it is in the public interest of Alberta to expend considerable effort and monies in the definition, conservation, management, and utilization of Alberta's water resources in the best interests of Alberta and Canada.

Furthermore, the Alberta government considers that when consideration of all uses of Alberta's fresh water resources are related to the present and future demands of its citizens that there are no surplus surface waters in Alberta.

In addition, the Alberta government considers that the present and future priority of water uses should be established on provincial and inter-provincial basis without influence by or from international considerations.

The Government of Alberta has placed a moratorium on the use of provincial government funds for use either in part or in total, for funding studies which involve the diversion of Alberta surface waters for export beyond the Canadian borders.

Also, the Alberta government has adopted the policy that each major impoundment and/or major interbasin diversion of water would have to be authorized by a separate Act of the Legislature. This policy will be incorporated in the appropriate statute.

With respect to water resources management, the government of Alberta will study and manage these resources on an individual water basin concept basis. Each major river drainage basin will be highlighted as an area for continuing water quantity and quality studies, use allocation and priority use classification, and overall management of existing supplies for optimum use and conservation. Government policies will encourage efficient and optimum use of the water resources within all river drainage basins. Intra-basin diversions will be studied and implemented where publicly desirable; however, inter-basin diversion studies and implementation will generally have low priority.

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It is the intention of the government of Alberta to develop a mechanism for public participation and public hearings in the planning process. It is expected that overall planning will be done on a regional or watershed basin basis, as well as on an overall provincial basis.

It is the intent of the government to establish water management regulatory bodies on a regional basis so that local and regional input into the overall management process can be increased.

Framed within the above overall government policy, the Department of the Environment is actively formulating an overall water management plan for Alberta, hereafter referred to as "The Alberta Water Management Plan".

In accord with the overall water management plan, the Government of Alberta will establish specific policy guidelines in a number of areas involving cost sharing arrangements between governments, as well as priority classification of project implementation.

W. J. Yurko, P. Eng.
Minister of the Environment

DRAFT

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OF THE ENVIRONMENT
GOVERNMENT OF ALBERTA

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To: The Honourable W.J. Yurko, P. Eng.,
Minister of the Environment,
Government of Alberta.

Sir:

The undersigned has the honour to transmit herewith the "Water Use Charges" Report.

The policy of the Government of Alberta is to assure effective management of the publicly owned water resources and to ensure that the people of the Province share in the benefits derived through use of the water. The authors have assessed the potential and implication of generally charging a fee for the use of water and provided adequate information for a base on which to make policy decisions.

I hereby wish to acknowledge the guidance and counsel to staff of Mr. R.E. Bailey, Director, and Mr. W. Solodzuk, Chief Engineer, Water Resources Division, plus the combined efforts of Messrs. C.R. Froelich, T.V. Mussivand, E.T. Podivinsky, C.L. Primus, J.H. Simpson, S.W. Smotrych, and many others in the compilation and editing of the material presented.

Respectfully submitted,

E. E. Ballantyne, D.V.M., P.Ag., F.R.S.H.

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Dr. E.E. Ballantyne D.V.M.
Deputy Minister of the Environment

Sir:

The undersigned has the honor to transmit herewith the Report, entitled "Water Use Charges".

This report is one of the series initiated following the two-day water policy seminar held on December 8-9, 1971, with the Honorable W.J. Yurko, Minister of the Environment.

This seminar was significant in establishing guidelines for the development of policies and priorities to foster intelligent management and use of the water resources of Alberta.

This report contains background information and recommendations respecting the concept of charging for the use of water in Alberta. A possible scale of charges is presented and the implications in terms of the potential effect on the water users and on society in general are discussed.

I trust that the contents of this report may be found useful by members of society and their elected representatives in determining action programs that will be in the best interest of the public of Alberta.

Respectfully submitted,

R.E. Bailey, P. Eng.
Director
Water Resources

SYNOPSIS

This report is one of a series associated with the proposed Alberta Water Management Plan. Alberta water is a public resource and the benefits from its use should accrue to the public at large. A suitable method for compensating society for the use of its resource is by charging for the privilege of using water. Such charges are made in a number of Canadian provinces and by water resource administrations elsewhere in the world. Further benefits of water use charges include the generation of funds for managing the resource and, by attaching a value to the resource, promoting wise and efficient use.

It is the policy of the Government of the Province of Alberta that charges will not be applied to the household use of water. The majority of other uses will be subject to charges according to a proposed scale. Presently proposed charges range up to a maximum of $20 per acre-foot of water.

It is estimated that the increased costs of production due to the contemplated scale will be less than one percent of product value for the majority of items. The charges applied to hydro-electric and thermal generation plants would represent approximately three percent of the current consumers price for power. Charges applied to irrigation, which have been designed to promote increased efficiency, would generally be in the order of one percent of the crop value.

Based on 1970 levels of water use, annual provincial revenue from the proposed charge would be approximately $8 million. This is made up of $4 million from the power generating industry, $3 million from general industrial and commercial users and $1 million from irrigation water use.

ACKNOWLEDGEMENTS

This report is the result of combined efforts of many individuals, particularly J.H. Simpson, S.W. Smotrych, C.R. Froelich, E.T. Podivinsky, C.L.Primus and their staffs. The report was prepared under the direction of T.V. Mussivand.

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INTRODUCTION

Purpose of the Study

The Water Policy Seminar held with the Minister of the Environment on December 8-9, 1971, resulted in suggestions for government policy in a number of major areas of water management. When formalized the various policy papers will be presented as components of the Alberta Water Management Plan. One of the sections to be included will deal with the introduction of widely applied charges for the use of the province's water resource.

The Water Resources Division was directed to assess the implication of introducing a charge for water and to assess the effect of a scale of water use charges discussed at the seminar. This report presents the preliminary view which emerged from the study.

Statement of Suggested Policy

The Government of the Province of Alberta proposes to extend the practice of charging a fee for the use of water to include the majority of water users in the province. However, it is the policy of the government that water use charges will not be imposed on the domestic use of water.

Scope of the Study

This report includes:

i) A discussion of the concept of water use charges and their role in the overall management of the water resource.

ii) An assessment of the factors to be considered in establishing a scale of charges.

iii) A statement of the proposed scale of charges and an assessment of the implications.

iv) Conclusions and recommendations arising from the study.

Data from many sources were utilized in carrying out the study. The sources of information are listed in the References. Due to the use of estimates where firm data was not available and due to the fact that average values were used for the most part, the results of the analysis should be taken as broad indications only.

CONCEPT OF CHARGING FOR THE USE OF WATER

Introduction

Alberta's water is a resource owned by and having value to the people of the province and country.

The value of this resource to society stems from the vital role water plays in enhancing the quality of life enjoyed by all its members. This value derives specifically from the potential of the resource to:

(a) Supply basic household requirements

(b) Contribute to agricultural and industrial development which help supply society's needs and support its economy.

(c) Provide a suitable environment for active and passive water-based recreational activities.

The quantity, quality and location of the resource are aspects which all have a great bearing on its value. No development can take place without water being available in the required quantity and quality. It is no exaggeration to state that water is an essential ingredient for any form of progress and development by society.

The value of the resource is realized through use. However, it is recognized that while some uses do benefit society in general, other uses serve to benefit only a limited sector. It is with this inequity in mind that the concept of a water use charge is introduced. Since water is a public resource,benefits from its use should accrue to the public at large. Those sectors which use the water should share the benefits of this use through water use charges.

The water resources of the Province of Alberta are wholly the right and privilege of the province. Permission to use the water resources for beneficial purposes may be granted to individuals, firms, and local authorities, but ownership of the resource is at all times retained by the province. Permission to use water may be withdrawn if conditions and priorities change. The overriding consideration must be for the public good derived from the use of this public resource.

Definition of a Water Use Charge

A water use charge is a payment to society collected through its government for the use of the publicly owned water resource. It in part compensates society at large for use of the water by individuals or groups within the province.

The concept of charging for the use of water is analagous to the established practice of charging for the use of other renewable resources. For example, the province levies charges through the Department of Lands and Forests for the use of the province's timber, fish, and wild life resources. The revenues are collected in the form of licence fees, leases, and permits. Total revenue in recent years from these sources has been in the order of $8 million.

Need For a Water Use Charge

The importance of Alberta's water resources, both to the residents of the province and to all Canadians, is becoming increasingly evident. Alberta's position on the headwaters of two of the major river basin systems on the continent creates additional requirements for comprehensive planning and management of this most critical resource. Water resource management decisions made now in the Province of Albe

will have far-reaching implications for present and future generations, both in Alberta and many other areas of Canada.

With the increased recognition for the need to manage water on a total river basin basis to preserve existing supplies and where necessary to enhance supplies to meet present and future needs, there follows an increased need for funds to plan and to manage this valuable resource. While costs related to the supply, treatment, and distribution of water can be recovered through service charges levied by the agencies providing the service, to date no revenues have been recovered for the broader aspects of water resource planning and management. A water use charge would be one mechanism to generate revenues for these essential activities. An alternative to a water use charge would be some form of general taxation to provide the funds necessary.

In addition to compensating society for the privilege enjoyed by some of using the water resource to generate benefits which do not accrue to society in general, a water use charge would also emphasize that water does have a value, and could in part compensate for any deterioration in the value of the resource through a particular use. All uses have some effect on the quantity or quality distribution of the resource and hence its potential subsequent utility.

A water use charge would be assessed directly against those licensed to use water. Indirectly, the charge should be borne by those who benefit from its use.

Use of Revenues Generated by a Water Use Charge

In the first instance the net revenues generated by a water use charge would accrue to the general income of the province. The

province expends considerable funds for the management of its water resources to assure that this resource contributes positively to the quality of life enjoyed by Albertans. The monies received would generally be directed towards the overall management of the water resource of the province. The areas of expenditure would be based on the policies and priorities established on a provincial basis. Items which would therefore be financed at least in part through the proceeds from the water use charge include:

a) Planning of water resource development including basic data collection and analysis, and comprehensive multi-disciplinary studies of the requirements within river basin areas.

b) Provincial contribution to cost-sharing arrangements for projects designed to conserve, control, or utilize water. Within the overall policy of government, the provincial share may be up to 100% of the total cost of approved projects. The total cost should include project planning, operation, and maintenance.

Possible Effects of a Water Use Charge

Both beneficial and undesirable effects to society could result from the imposition of a water use charge. The application of a charge has the potential to provide revenues for society, to create an incentive for wise use of the resource and to discourage wasteful practices, and to provide one basis for society to allocate and possibly reallocate its increasingly scarce water resource, based on supply, demand, and priorities of use. However, unless an equitable and easily applied rate schedule is employed, the imposition of a water use charge

could discourage desirable new development from locating in Alberta as well as causing economic hardship to existing developments. The rate schedule selected must ensure that the advantages of a water use charge would outweigh any disadvantages. This potential problem has been recognized and it is estimated that the presently contemplated charges would have a minimal effect on virtually all of the users who will be subject to a charge.

Consumer Safeguard

It is recognized that the additional costs due to water use charges may be passed on to the consumer in terms of increased prices. Government policing will ensure that the water use charges are not used to justify consumer cost increases in excess of those actually resulting from the imposition of the charges.

EXISTING WATER USE CHARGES

Alberta

At the present time the only water use subject to a provincial charge is water used for the generation of hydro-electric power. This charge is related to the quantity of power generated, and in 1970 resulted in revenues to the province of approximately $200,000. The only other fee levied by the province associated with the use of water is an initial charge for the issuance of a water license.

There is provision under the Water Resources Act for the Province of Alberta to impose a charge for the use, diversion, or storage of water. This general provision is contained in a separate section from that applied to the hydro-electric industry. To date, this general provision under the act has never been applied.

Table 1 summarizes the present situation in Alberta. Further details of the rates applied to the hydro-electric industry, the water license fees, and the general provisions under the act are contained in Appendix A.

Rest of Canada

All provinces in Canada, except New Brunswick and Prince Edward Island, impose some form of provincial water use charge. The bulk of the charges apply to the hydro-electric industry. This is illustrated by the fact that in 1970 total revenues in Canada from water use charges amounted to approximately $5 million, of which approximately $4.2 million or 84% was levied against the hydro-electric industry.

TABLE I

CURRENT WATER USE CHARGES IN ALBERTA

Type of Charge	Item	Charge	Annual Revenue (1970)
For Use of Water as a Natural Resource	1. Hydroelectric power generation	Sliding Scale of Charges from $1.00 to $1.30 per hp-year based on annual load factors of 100% to 40% and under	$200,000
	2. Diversion, or storage of water	Nil	This charge is provided for in the Water Resources Act, but has never been applied
Licence	3. Water licence issuance	Sliding Scale of Charges from $.10 to less than $.01/acre-ft. based on volume used.	$1500
Associated with Supply or Development	4. Water furnished by licensee	Determined by licensee	Nil
	5. Service or facilities provided by the Government	Nil	This charge is provided for in the Water Resources Act, but has never been applied.

Table 2 presents typical charges applied by the provinces. The rate structure for water used in hydro-electric generation is generally based on the amount of power produced with adjustments for the proportion used for supplying peak requirements. Of the total $4.2 million revenues, approximately $3.4 million was raised in British Columbia and $0.6 million in Saskatchewan.

British Columbia, Newfoundland, Nova Scotia, Quebec, and Saskatchewan impose water use charges for other than hydro-power. British Columbia and Saskatchewan have the most comprehensive system of water use charges. Non hydro-power uses of water contributed approximately $0.8 million in revenues in 1970, the majority of which was raised in British Columbia.

In British Columbia the policy for water charges varies according to type and volume of use. In Saskatchewan the rate structure is based on user class, quantity used, water quality, and source of supply. All irrigation, domestic, and conservation use water is excluded from a charge, as is some groundwater. Also free is any usage of less than 15 acre-feet. Further details on specific charges are included in Appendix A.

Other Countries

Only a small number of states within the United States of America impose a water license charge or a water use charge.

Of the 31 State agencies responding to a questionnaire only four impose a water use charge of any kind. These states are New Jersey, New York, Pennsylvania, and Alabama. New Jersey charges for irrigation, domestic, and industrial uses; New York for irrigation and hydro uses; Pennsylvania for domestic use; and Alabama

TABLE 2

CURRENT PROVINCIAL WATER USE CHARGES IN CANADA

	Hydro-Power $/hp-yr.	Irrigation $/ac-ft.	Domestic $/ac-ft.	Industrial $/ac-ft.	Recreation-Conservation $/ac-ft.
Alberta	1.00-1.30	0	0	0	0
British Columbia	0.33-0.82	0.10	1.5-3.7	.01-.74	.0014
Manitoba	1.25	0	0	0	0
Northwest Territories and Yukon	.75-1.30	0	0	0	0
New Brunswick	0	0	0	0	0
Newfoundland	3.73	0	0	.05 per licenced acre	0
Nova Scotia	.125-.25	not available	0	arbitrary charge	0
Ontario	1.95-2.45	0	0	0	0
Prince Edward Island	0	0	0	0	0
Quebec	3.00-3.98	not available	.01(storage only)	.033(storage only)	not available
Saskatchewan	1.25	0	0	0-15.00	0

Additional information and water licence charges are presented in Table 16 in Appendix A.

for industrial use. A summary of information obtained from the questionnaire is included in Table 3.

Information from other countries is quite incomplete; however, from information at hand, there is obviously a variety of methods under which monies are generated for water development, including revenues raised through licensing and revenues raised through general taxation. There would appear to be some relationship between the method used to raise revenue and the ownership of the water resource, which in some areas is not considered to be vested in the state.

TABLE NO. 3

CURRENT WATER USE CHARGES IN THE UNITED STATES

State	Hydro Power	Irrigation	Domestic	Industrial	Recreation
New Jersey	no information	$.13/ac.ft. for every ac.ft. in excess of .37 ac.ft./day	$.27/ac.ft. to $2.70/ac.ft. according to available stream flow.	$2.70/ac.ft. in excess of .36 ac.ft./day	no information
	No information on license fees.				
New York	Flat rate rental charges exist for hydro. Rental rate ranges from $32,500/annum to $1,100,000/annum	$.25/inch diameter siphon per month	Municipal water charge is under the authority of each County. It is questionable whether this charge is a water use charge or a water supply recovery cost	no information	no charge
	New York also has water license charges.				
Pennsylvania	no charge	no charge	½ of 1% of the gross profit that results from sale of water by the supplier if reservoir is on State land.	no charge	no charge
Alabama	no charge	no charge	no charge	$29.95/ac.ft.	no charge
Rhode Island	Under state legislation the Water Resources Board has authority to purchase and sell water. From the information available there is no indication that this has ever been done.				
Oregon, Iowa, Washington, Oklahoma, Nevada	No water use charges in these states however they do have nominal license fee charges for most uses of water.				
California	No water use charge in this state however under the California State Water Project. 31 public agencies will enter into contracts with the state to provide water service for many uses including municipal, agricultural and industrial. These agencies will pay two charges: one a unit charge for the water development service and the other a charge for their share of project capital and annual operating and maintenance expense. Cost associated with uses such as recreation, fish, wildlife and flood control are paid by the State and Federal Government.				
W. Virginia, Utah, N. Dakota, New Hampshire, Connecticut, Montana, Illinois, Virginia, Florida, Massachussetts, Hawaii, New Mexico, Ohio, Delaware, Puerto Rico, Kansas, Wyoming and Tennessee, Maine, Arizona	From the information available these states do not levy any water use charge or water license charge.				

Notes: 1. Information obtained from 31 States

2. Charges listed are "royalty" charges and are not designed to recover development costs.

WATER USE IN ALBERTA

It is estimated that approximately 14 million acre-feet of water were used in Alberta during 1970. This does not represent a net withdrawal of this volume of water from the province's water resource however, as in most cases a large portion of the flow diverted for use is subsequently returned to the river and available for further use downstream. For example, of the 14 million acre-feet used during 1970 approximately 11 million acre-feet were diverted for hydro-electric generating plants.

Six major categories of water use have been defined and are shown in Table 4.

TABLE 4 - MAJOR CATEGORIES OF WATER USE IN ALBERTA

Major Category of Water Use	Description
1. Domestic	Water supplied for residential purposes through a municipal water works system as well as that used in rural areas from surface or groundwater sources.
2. Institutional and Public	Water used in hospitals, schools, etc., as well as that used by government. It also includes general municipal use for fire fighting, street cleaning, etc.
3. General Industrial and Commercial	Water supplied through a municipal water works system as well as from privately developed sources. It includes water used for manufacturing and processing, mine and mineral recovery, commercial activities, and all other uses not included in the five other major categories.
4. Thermal electric plants	Water used for cooling and other purposes associated with the generation of thermal electricity.
5. Hydro-electric plants	Water used for generation of hydro-electricity
6. Irrigation	All water diverted for irrigation purposes.

The amount of water used within each category has been estimated for the year 1970. These estimates, together with the projected requirements for 1975 and potential requirements for 1990, are summarized in Table 5. It is noted that while reasonable confidence may be attached to the 1975 projection, in order to estimate the potential requirements in 1990 a number of very broad assumptions had to be made, particularly with respect to the requirements for electric power generation and irrigation. A statement of the assumption and the basis for projecting the water requirements are included in Appendix B.

TABLE 5 - PRESENT AND PROJECTED WATER REQUIREMENTS IN ALBERTA

Major Category of Water Use	Requirement in Acre-feet/Year Estimated 1970	Projected 1975	Potential 1990
Domestic	170,000	184,000	220,000
Institutional and Public	25,000	30,000	40,000
General Industrial & Commercial	239,000	263,000	360,000
Thermal Electric Plants	1,078,000	1,407,000	6,000,000
Hydro Electric Plants	11,128,000	11,500,000	13,000,000
Irrigation	1,290,000	1,500,000	2,000,000
Total for all Categories	13,930,000	14,884,000	21,620,000

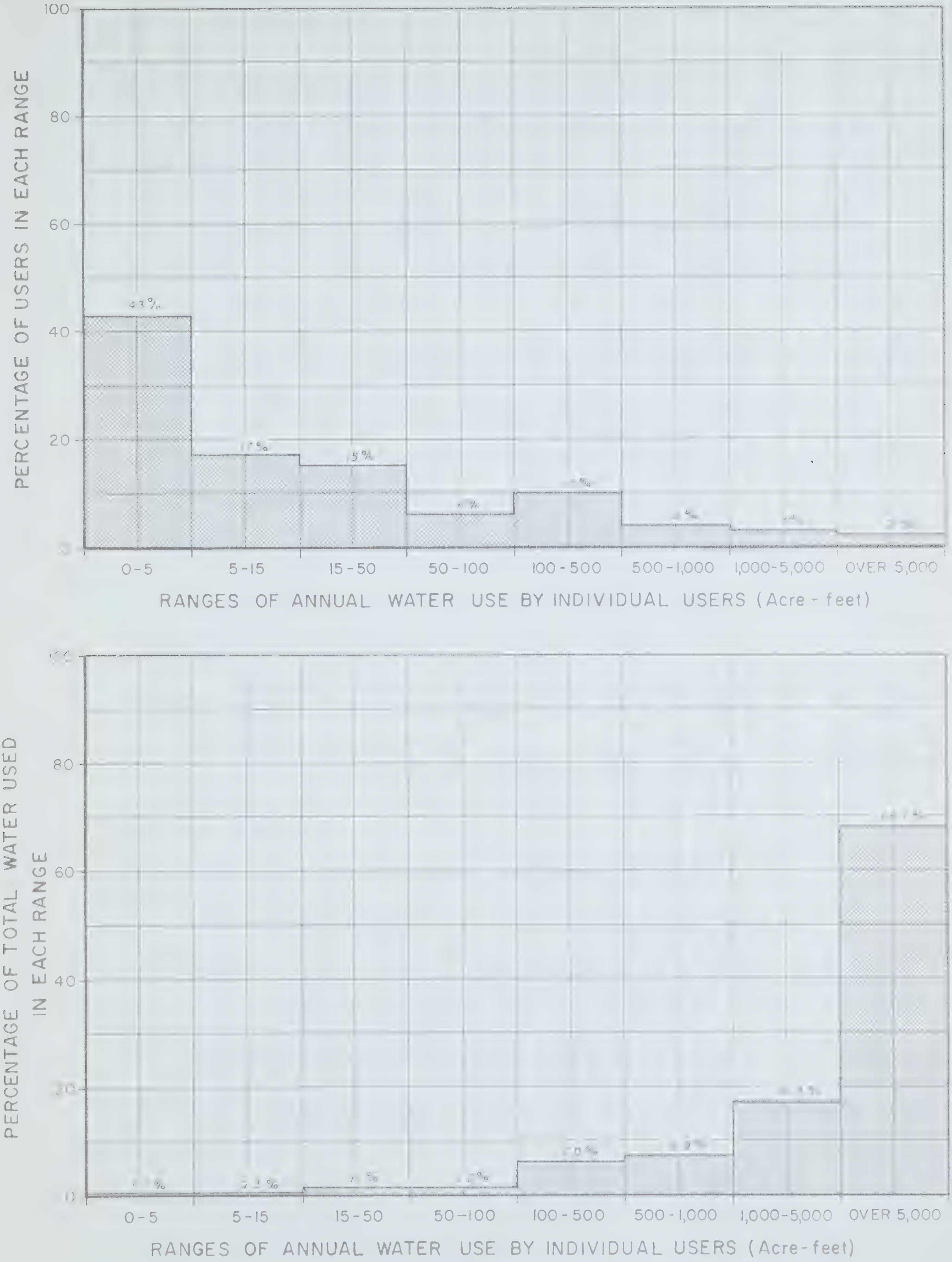
The general industrial and commercial category of water use is extremely diversified. A partial breakdown of the category indicating the water use by a number of major industries is presented in Table 6.

TABLE 6 - GENERAL INDUSTRIAL AND COMMERCIAL WATER USE IN 1970

Type of Industry	Estimated 1970 Water Use (acre-foot)	Percentage of the Total General Industrial and Commercial Water Use
Meat Processing	17,000	7%
Beverage	3,000	1%
Dairy	1,000	1%
Oil field Flooding	50,000	21%
Natural Gas Processing	14,000	6%
Petroleum Products	33,000	14%
Chemical Products	73,000	30%
Other	48,000	20%
Total	239,000	100%

More detailed information relating to the water requirements of particular industries is included in Appendix B. The majority of water users in this category use relatively small volumes of water. In fact 60% of the users account for less than 1% of the annual use of the entire category. This is illustrated on Figure 1.

Approximately 60% of the water used for domestic purposes is supplied through municipal water works systems, as is approximately 20% of the water used for general industrial and commercial purposes. All of the water used for irrigation and power generation and almost 85% of that used for other purposes is obtained from surface water sources. Further information relating to the amounts of water supplied through municipal and private systems and the proportion between surface and groundwater sources is included in Appendix B.



CHARACTERISTICS OF GENERAL INDUSTRIAL AND COMMERCIAL WATER USE

FIGURE 1

ESTABLISHING A FRAMEWORK AND RATE STRUCTURE

Criteria for Evaluating Alternative Rate Structures

The purpose of this section is to present the broad framework defining the categories of water uses which could be subject to a charge and the basis upon which a rate structure could be founded. However, first the criteria adopted for evaluating alternative rate structures are discussed.

In order to be effective the rate structure must be

(a) Equitable. Various sectors of water use must be treated on a uniform basis. Different users within a sector must be treated equally.

(b) Acceptable. The rate structure must be generally acceptable to the water user and to society.

(c) Practical. The policy and rate structure must be easy to apply. Measuring and billing procedures must be simple to administer.

(d) Rational and related directly to the quantity of water used.

In order to allow users to incorporate the effects of the charge into their operations it is desirable that the rates be set for a fixed period, say 5 years; however, there must be provision for a review of the rate structure after each such period.

It is important that the charges be recognized as being charges for the use of Alberta's water resource and not viewed as just another form of taxation.

Water Users Subject to a Charge

It is the policy of the Government of the Province of Alberta that no water use charges be imposed on the domestic use of water. Similarly, no charges will be applied against public recreational use, including the conservation of fish and wildlife. Public and institutional use of water will also be exempt from a charge. Water use charges will be applied to all licensed withdrawals for industrial, municipal excluding domestic public and institutional, irrigation, stockwatering, power generation, and other uses excluding public recreation.

Factors Pertinent to Establishing a Rate Structure

(a) Value of the resource to society. Considerations which affect the value to society, and hence could be influential in determining the charge to be levied, include:

i) Net depletion through use
ii) Deterioration in quality through use
iii) High volume use in area of short supply
iv) Desire to encourage regional economic development.

These factors are more pertinent to the comparing of the relativity of rates rather than establishing absolute rates. It is considered that a water use charge scale is not the optimum medium for imposing society's wishes with respect to the use of the resource. Rather this derives from comprehensive planning and regulation.

(b) Value of the resource to the user. This is related solely to the revenue generated through the use. It is a function of the net revenue from the sale of goods and quantity of water used.

Numerous studies have been reported in which attempts have been made to estimate the value of water to specific industries or enterprises based on an economic analysis. It would appear that the

techniques for carrying out this type of analysis are by no means agreed upon.

The net revenue generated by a water use is affected by the costs associated with withdrawing, treating, storing, distributing, and disposing of the water. These costs vary from industry to industry and from location to location. At the present time the scale of charges will not be related directly to the benefits derived.

(c) Potential economic effects. It is reasonable to assume that most enterprises reflect an equilibrium between production costs, selling price of products, and profit to the producer. An increase in the cost of any resource would have a corresponding effect on production cost. This increase may:

- i) be absorbed by the producer
- ii) be passed to the consumer
- iii) result in modifications to the enterprise; such as recycling or other means to reduce the amount of water used.

Because of the wide variation in rate of water use between different uses and even between different users producing the same type of product, the potential economic effects would vary widely. In addition the ability of an individual producer to set a price for his product varies with the type of product and the market.

(d) Rates charged elsewhere. A difference in rates between water resource agencies may be one factor which would affect the location of new development. In addition, the rates charged elsewhere provide a guideline for what has been found to be acceptable.

(e) Revenue required. The revenue raised through application of water use charges is of course directly related to the rate structure adopted.

Basis for Defining a Rate Structure

The qualitative and conflicting nature of many of the factors outlined above is apparent, and it is almost impossible to design a rate structure which would quantitively reconcile all factors. A rate structure which did attempt to incorporate all of these factors would be extremely complex, and correspondingly complex to administer.

However, it is recognized that within a particular industry or user class, many of the factors which affect a feasible range for water user charges are reasonably constant.

It is concluded that the following is the most practical procedure for establishing a rate schedule:

a) Define broad categories of uses to be subject to different rates.

b) Define a rate schedule reflecting as many of the factors outlined as possible.

c) Refine the schedule based on an analysis of its potential effect

d) Provide the water user and society in general with an opportunity to comment on the proposal

e) Finalize the rate structure.

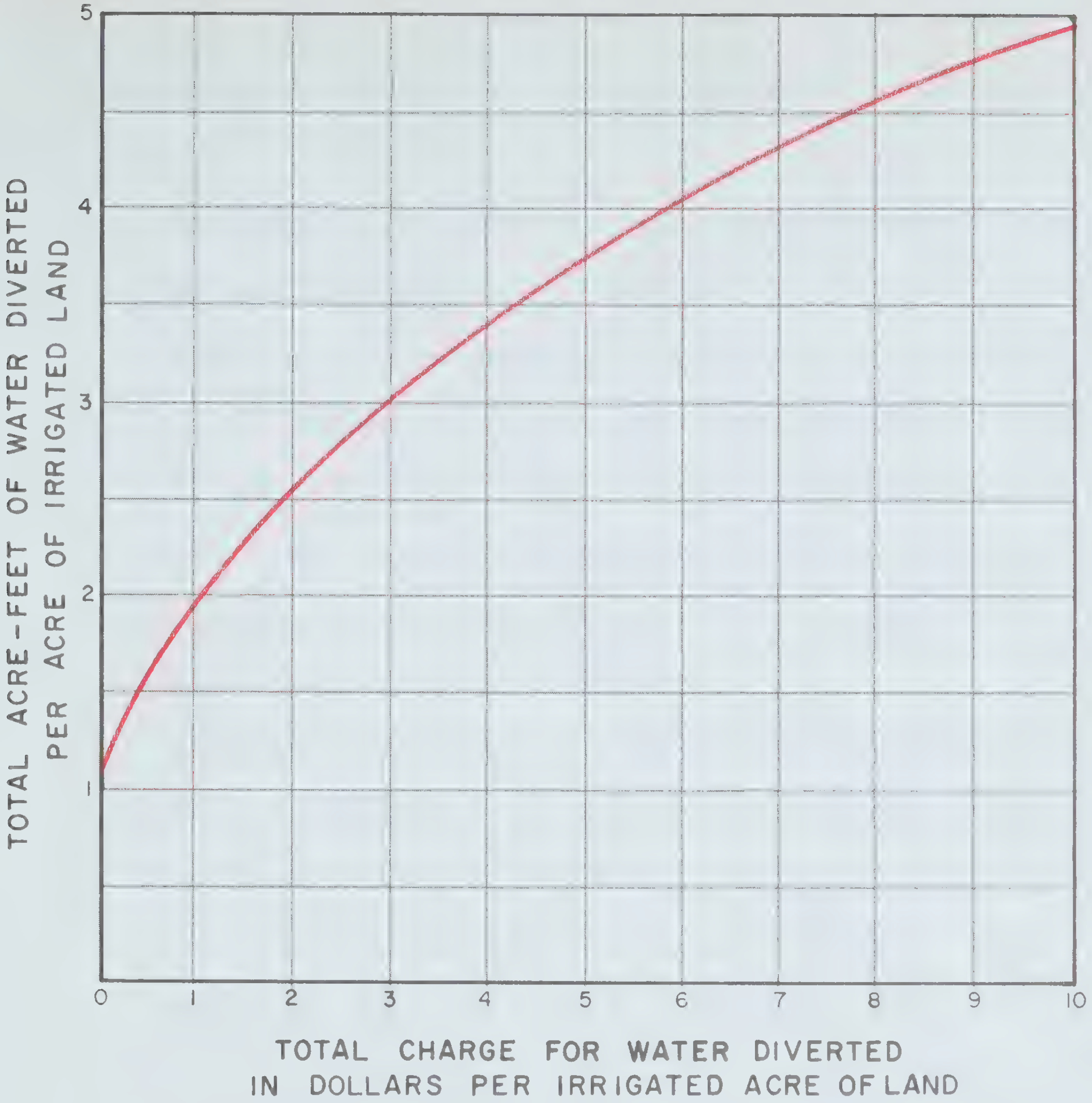
Proposed Scale of Water Use Charges

The proposed scale of charges has been established according to the procedures outlined above. It is presented in Table 7. This scale of widely applied charges would replace the charges presently levied.

TABLE 7 - PROPOSED SCALE OF WATER USE CHARGES

Major Category of Water Use	Description of Uses Included in the Major Category	Basis for Calculating The Charge	Charge
Domestic	Water supplied for residential purposes through a municipal water works system as well as that used in rural areas from surface or groundwater sources	No Charge	No Charge
Institutional and Public	Water used in hospitals, schools, etc., as well as that used by government. It also includes general municipal use for fire fighting, street cleaning, etc.	No Charge	No Charge
General Industrial and Commercial	Water supplied through a municipal water works system as well as from privately developed sources. It includes water used for manufacturing and processing, mine and mineral recovery, commercial activities, and all other uses not included in the five other major categories	Annual Volume of Water Withdrawn	$10 per acre-foot
Thermal Electric Plants	Water used for cooling and other purposes associated with the generation of thermal electricity	Annual Volume of Water Withdrawn	$3 per acre-foot
Hydro Electric Plants	Water used for generation of hydro-electricity	Annual Quantity of Power Generated	$3 per horsepower year
Irrigation	(i) Water used in an Irrigation District	Annual Volume of water diverted into the District and total irrigated area.	No charge for the first acre-foot per irrigated acre. Charges for additional use according to the Sliding Scale in Figure 2.
	(ii) Water used for irrigated farming outside of an Irrigation District	Annual Volume of water diverted and total irrigated area.	No charge for the first acre-foot per irrigated acre. Charges for additional use according to the Sliding Scale in Figure 2.

In addition to the charges laid out above a surcharge of $10 per acre-foot will be applied for all uses, such as for oil field flooding, which result in a large portion of the water used not being available for subsequent users.



Amount of Water Diverted into Irrigation District per Irrigated Acre	Total Charge per Irrigated Acre
Upto and including 1 acre-foot	No Charge
Upto and including 2 acre-feet	$1
Upto and including 3 acre-feet	$3
Upto and including 4 acre-feet	$6
Upto and including 5 acre-feet	$10

SCALE OF CHARGES FOR WATER
WITHDRAWN FOR IRRIGATION

FIGURE 2

A number of the factors considered in establishing the rate scale are discussed below.

a). "Non-returnable" water - A surcharge of $10 per acre-foot will be applied against uses of water which effectively prevent its subsequent use by others. For example oil field flooding, in which large volume of water are pumped into the ground to recover oil is regarded as such a use. The charge in this case would therefore be a basic charge of $10 per acre-foot plus a surcharge of $10 per acre-foot, for a total charge of $20 per acre-foot for surface water pumped into the oil fields.

b). Hydro power generation - The power produced at any given generating site is dependant on the flow and also the head of water. There is not therefore a generally applicable relationship between water used and power produced. Charges have therefore been based on the amount of power produced. The proposed charge of $3 per horsepower year would replace the existing "water rental" charges.

c). Irrigation water use - Irrigation farming is very sensitive to the effect of the potential water use charges. Generally the prices for products are established by market conditions which extend outside of Alberta. It is likely that additional costs due to a water use charge would generally have to be absorbed by the irrigation farmers of Alberta.

However, due to the many miles of main canals and laterals serving the Irrigation Districts, the distribution efficiency is not high. In addition there are situations where the full diverted flow from the river is not

subsequently utilized by the farmer and is returned through drainage channels.

It is desirable that the value attached to water as a resource should not significantly affect the economic viability of the irrigation enterprises, but should at the same time provide an incentive to improve efficiencies. It is suggested that this may be achieved by charging for irrigation water according to a sliding scale. Relatively low charges would apply to the amount of water reasonably estimated as being required. Much higher charges would be applied to diversions in excess of this.

As indicated in Table 7 the first 12 inches of water diverted into the district per acre of irrigated land would be free of charge. Additional water would be charged according to the sliding scale.

MECHANISM FOR COLLECTING A WATER USE CHARGE

The administration and collection of the charges must be as simple and practical as possible. A system of water use charges could be imposed using the existing water licencing procedure.

For irrigation water use it would be desirable to be able to measure water used on a per farm basis. However this would introduce a large number of individual users to be measured. The alternative is to measure the diversion to the irrigation districts and apply the charge to the district. This would have the following advantages.

i) Charges would be against established and organized groups

ii) Number of billings is minimized

iii) As the districts would administer and recover the charges from the farmers, the governments administrative costs would be minimized.

Passing the responsibility for recovering the charges to the districts does not eliminate establishing a basis for charging the individual farmer. It would seem reasonable to expect them to base a farmer's contribution to the district's water use charge on either his assessed, serviced or irrigated area. This of course decreases the incentive for individual efficiency, however in the absence of a better alternative, this sacrifice would be made for practicability of administration. The onus would be on the district to attempt to improve overall efficiencies.

Each individual, firm, or municipality licensed to use water for purposes subject to a water use charge would be required to submit an annual statement of water use, with an accompanying payment at the existing rate. Failure to submit an annual statement, or submission of incorrect data may result in a fine or the revoking of the licensee's water right or both.

Specifically, each water use sector would be charged on the following basis:

1. The operator of each municiple water supply system would submit an annual statement of total water usage, with documented account of types of water use (domestic - residential, industrial, commercial, public, and other) plus payment for all water used which is subject to a charge.
2. Each irrigation district would submit an annual statement showing the irrigated area and the total acre-feet of water diverted into the system plus payment for that quantity subject to a use charge.
3. Each hydro-electric utility would submit a statement on annual horsepower produced, and payment for same.
4. All other licensees, excluding public recreation and conservation, would submit annual statements on volumes of water withdrawn or stored, and payment for same.

Ten percent of the revenues collected by municipalities, irrigation districts or other agent collecting the charges from the direct users would be remitted to them to cover administration costs associated with collecting the fees.

POTENTIAL EFFECTS OF PROPOSED SCALE OF CHARGES

Introduction

The potential effects of the proposed scale of water use charges have been assessed from a number of aspects. These include:

i) Increased production costs related to the value of typical Alberta products

ii) Potential revenue to the province

iii) Effect on the consumers in Alberta

iv) Effect on the producers in Alberta

The major water using sectors which have been considered are the manufacturing and processing industries, mine and mineral recovery operations, hydro and thermal electricity generation, and irrigation. An attempt has been made to assess the overall impact on the water user and consumer in Alberta.

Although a specific scale of charges has been proposed, the graphs in this section have been prepared where ever possible to illustrate the effects of a range of charges. This enables the implication of alternative rates to be assessed, both in terms of revenues to the province and effect on production costs.

The data used in the analysis pertaining to water use, quantity and value of production etc. were derived from several sources. Where information was not available it was estimated. Due to the variability of most of the factors considered, and the use of average figures, the results of the analysis should be taken as broad indications only. There has been no allowance made for a possible decrease in water use resulting from imposition of a charge.

Summary charts and tables are included in this section. Further details of the procedures adopted in the analysis and sources of data are contained in Appendix C.

Effect of Water Use Charges Related to the Manufacturing and Processing Industries

a) General. Many of these industries are supplied from a municipal water works system. The remainder have developed a private supply system. The sector is quite diverse, and includes food processing, petroleum and chemical production, and manufacturing. The increased costs due to the imposition of a water use charge would be borne both by consumers in Alberta, and by consumers of products exported from the province.

b) Additional manufacturing and processing costs related to product value. Table 8 shows the additional processing cost due to a water use charge of $10/acre-foot as a percentage of the selling price of various products. Although the range between individual products is quite large, the overall effect would be very small. The increased production cost for food items should not generally exceed a tenth of one percent of the product selling price. Increased costs for other items range up to one percent of the recent product selling price.

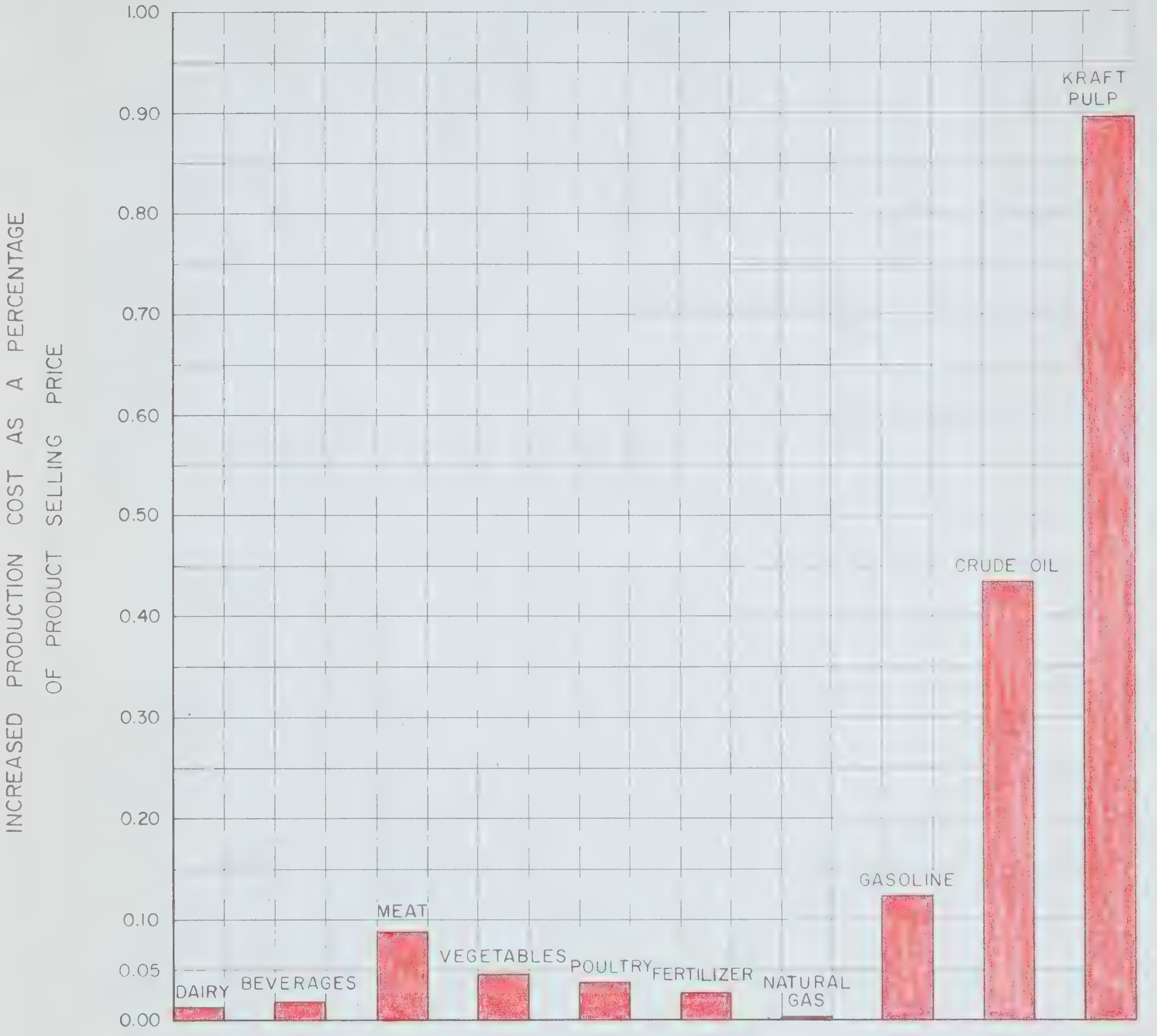
Figure 3 illustrates the relative increases which could result in a number of particular industries.

c) Potential revenue to the province from the manufacturing and processing industries. As indicated on Figure 4, the total potential revenue from a $10 per acre-foot water use charge would amount to approximately $2 million based on 1970 levels of water use.

TABLE NO. 8

POTENTIAL INCREASED PRODUCTION COSTS OF A NUMBER OF ALBERTA PRODUCTS DUE TO A WATER USE CHARGE OF $10 PER ACRE-FOOT

Product	Selling Price (1972)	Water Requirement for Processing	Increase in Cost Due to a $10/Acre-Foot Water Use Charge	Increase in Cost as a Percentage of Selling Price
Bread	$0.25/loaf	.25 gal/loaf	.00092¢/loaf	.004%
Milk - Evaporated - Skim Milk Powder	$0.30/qt.	.83 gal/qt. 4.95 gal/lb.	.00305¢/qt. .0182¢/lb.	.010%
Cheese	$1.10/lb.	3.00 gal/lb.	.011¢/lb.	.010%
Butter	$0.74/lb.	2.20 gal/lb.	.0081¢/lb.	.011%
Vegetables	$0.30/lb.	3.50 gal/lb.	.0129¢/lb.	.043%
Meat	$0.95/lb.	21.5 gal/lb.	.0790¢/lb.	.083%
Poultry	$0.50/lb.	4.73 gal/lb.	.0174¢/lb.	.035%
Beer	$2.75/case (3/4 gal.)	17.0 gal/gal.	.0625¢/gal.	.017%
Soft Drinks	$0.15/bottle (10 oz.)	8.6 gal/gal.	.0316¢/gal.	.013%
Gasoline	$0.50/gal.	16 gal/gal.	.059¢/gal.	.118%
Natural Gas	$0.12/1000 cf	.32 gal/1000 cu.ft.	.00118¢/1000 cu.ft.	.001%
Fertilizer	$80.00/ton	500 gal/ton	1.84¢/ton	.023%
Kraft Pulp	$165/ton	40,135 gal/ton	$1.47/ton	.89%
Crude Oil	$2.52/bbl	29.563 gals/bbl	1.09¢/bbl	.43%



INCREASED PRODUCTION COSTS IN THE MANUFACTURING & PROCESSING INDUSTRY DUE TO A WATER USE CHARGE OF $10 / acre - foot.

FIGURE 3

POTENTIAL REVENUE FROM MANUFACTURING AND PROCESSING INDUSTRIES THROUGH A WATER USE CHARGE

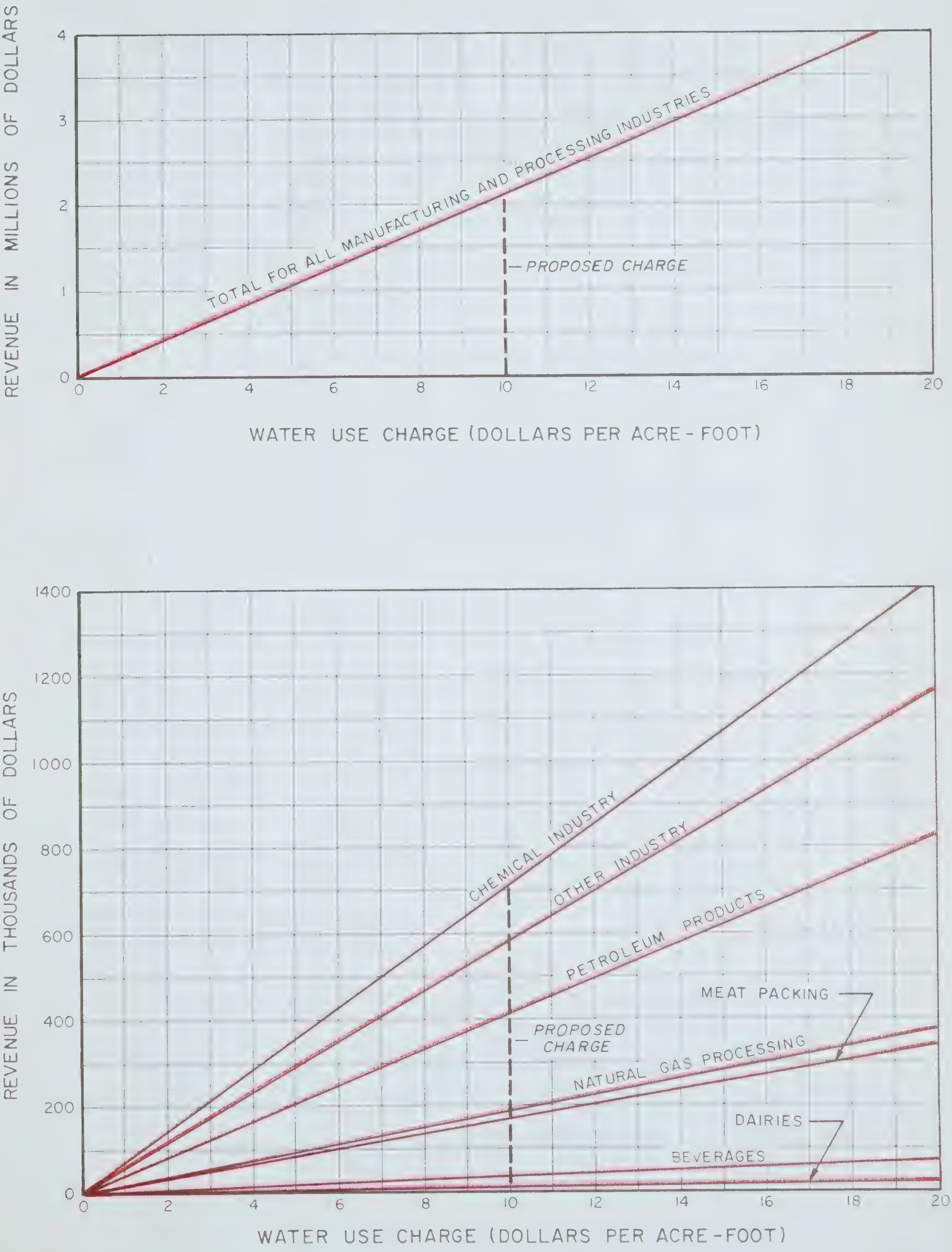


FIGURE 4

Effect of Water Use Charges Related to Mine and Mineral Recovery Operations

a) General. The major water use considered in this sector is that in oil field flooding. While the production in terms of crude oil is not directly proportional to the amount of water used, average values have been used in the preparation of the accompanying graphs.

This may be regarded as a consumptive use as for all intents and purposes the bulk of the water used is not subsequently directly available to subsequent users. This use of water will be therefore subject to a surcharge of $10 per acre-foot additional to the basic charge of $10 per acre-foot. The total charge for water used in oil field flooding will be $20 per acre-foot.

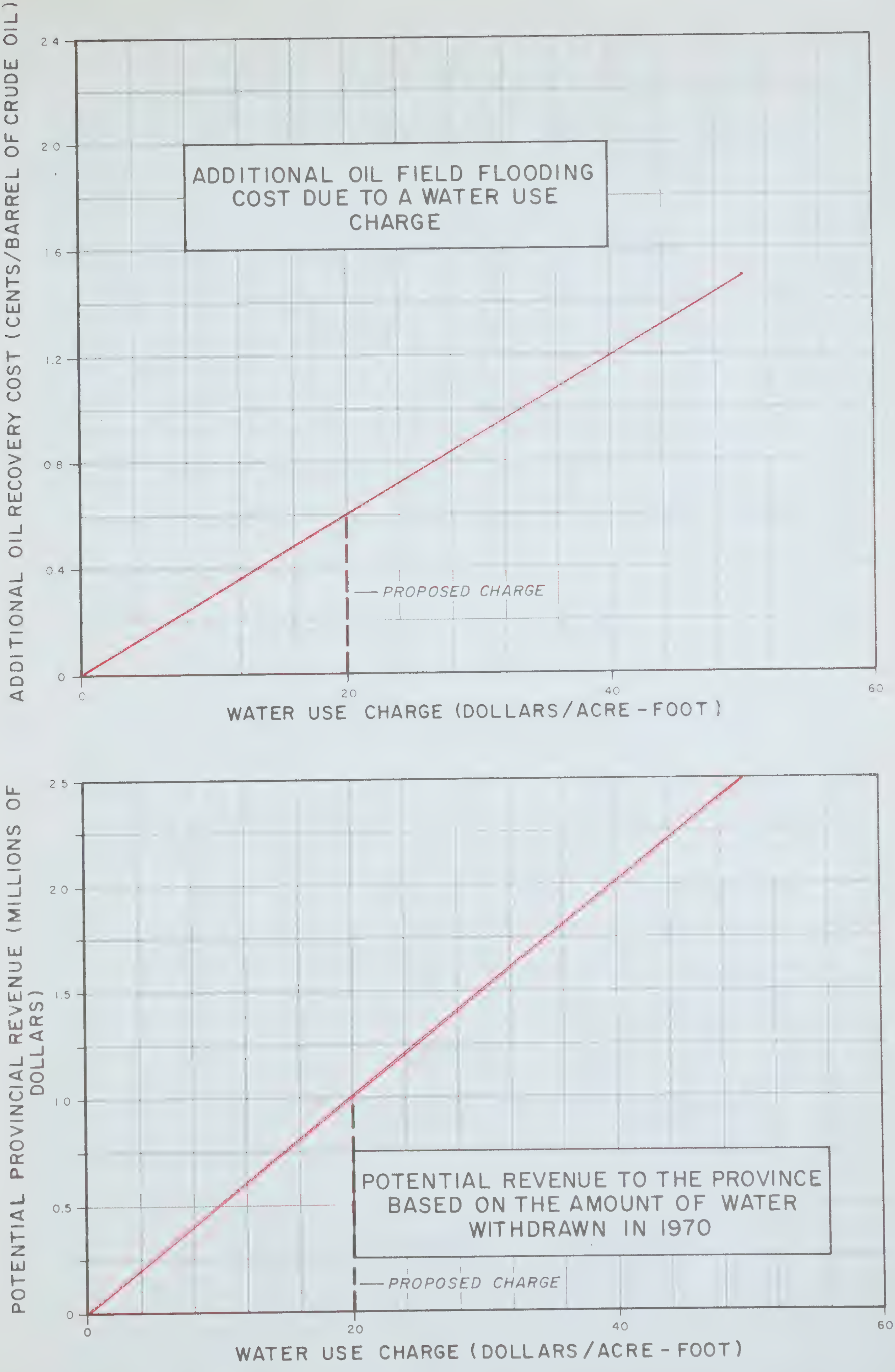
The amount of water used for this purpose is projected to almost double over the next 10 years.

b) Additional production cost. The additional cost associated with oil field injection for a range of water use charges is shown in Fig. 5. The additional costs are based on average production and water use figures.

Due to the considerable variation between different locations of the amount of water necessary to be injected into the oil field to yield the oil, the application of the charges may become an important factor as to the economic viability of marginally producing wells.

c) Effect related to product value. A water use charge of $20 per acre-foot could represent an increase in cost of approximately 0.6¢ per barrel or 0.3 percent of the current product value.

d) Potential revenue to the province. Potential revenue from a water use charge applied to water used for oil field flooding is



EFFECT OF APPLYING A WATER USE CHARGE
TO OIL FIELD FLOODING

FIGURE 5

shown on Figure 5, which is based on 1970 levels of use. A charge of $20 per acre-foot would raise approximately $1 million.

Effect of Water Use Charges related to Power Generation

a) General. The bulk of the water used in Alberta is used in the production of electrical power. A large volume of water is diverted through hydro-electric plants. A lesser but still significant volume of water is used for cooling and other purposes in thermal generating plants. The relationship between amount of water used and power produced for hydro-electric and thermal plants is presented in Table 9.

TABLE 9

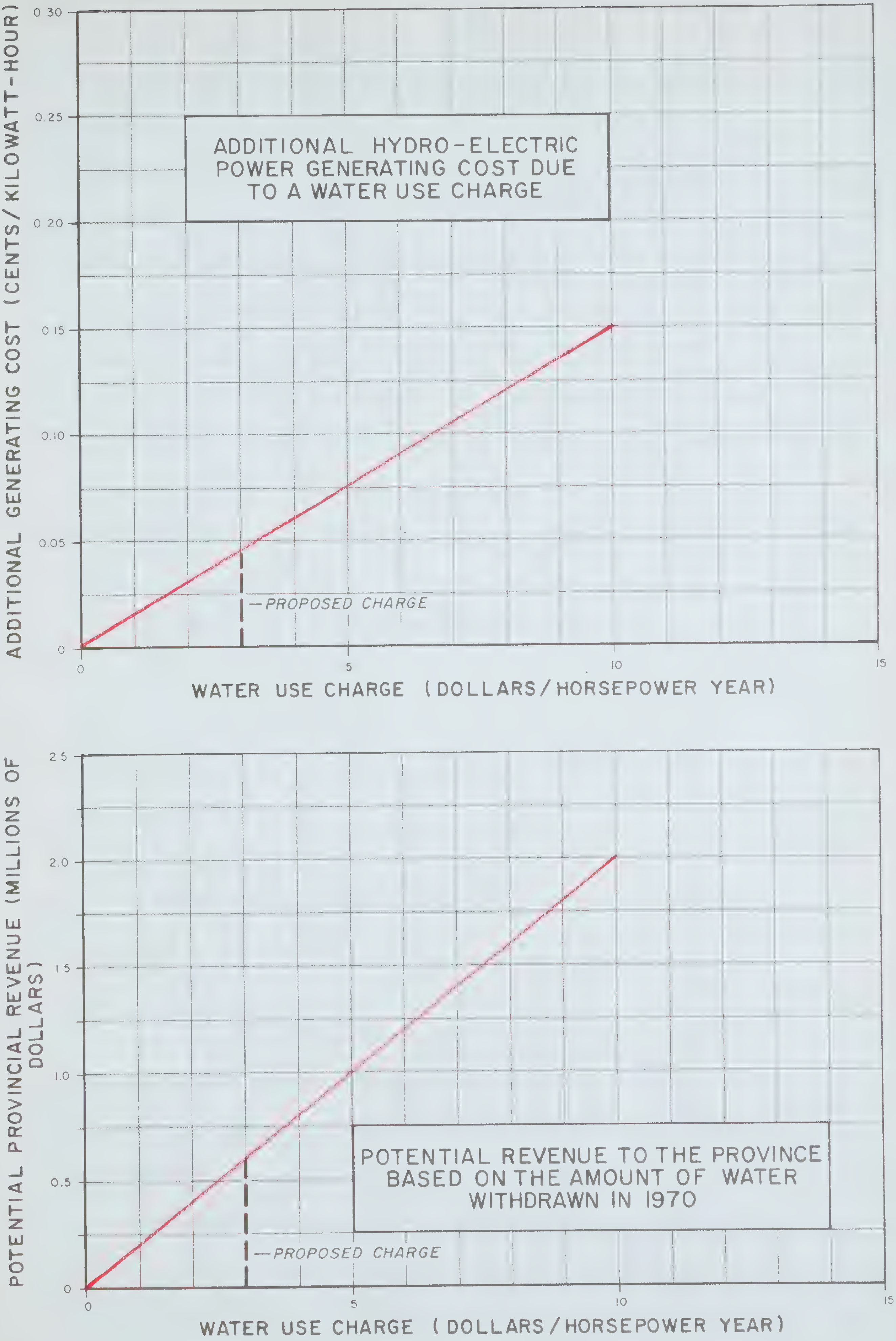
WATER USE AND POWER GENERATED FOR HYDRO-ELECTRIC AND THERMAL PLANTS, 1970

Type of Generating Plant	Water used for Generating Power		Power Generated	
	Million Acre-Feet	% of Total	Million KWH	% of Total Power Generated
Hydro-electric	11.1	90%	1,200	13%
Thermal	1.1	10%	7,800	87%

In order to maintain the equilibrium between hydro-electric and thermal plants, it is desirable that a water use charge effect them in a similar fashion. In terms of increased generating costs a charge of $1 per hp/year applied to hydro-electric plants is approximately equivalent to a charge of $1/acre-foot applied to thermal plants.

b) Additional generation costs - hydro-electric plants.

The power produced at any given hydro generating site is a function of the flow of water diverted through the plant and the head available. There is not therefore a generally applicable



EFFECT OF APPLYING A WATER USE CHARGE TO HYDRO-ELECTRIC POWER GENERATION

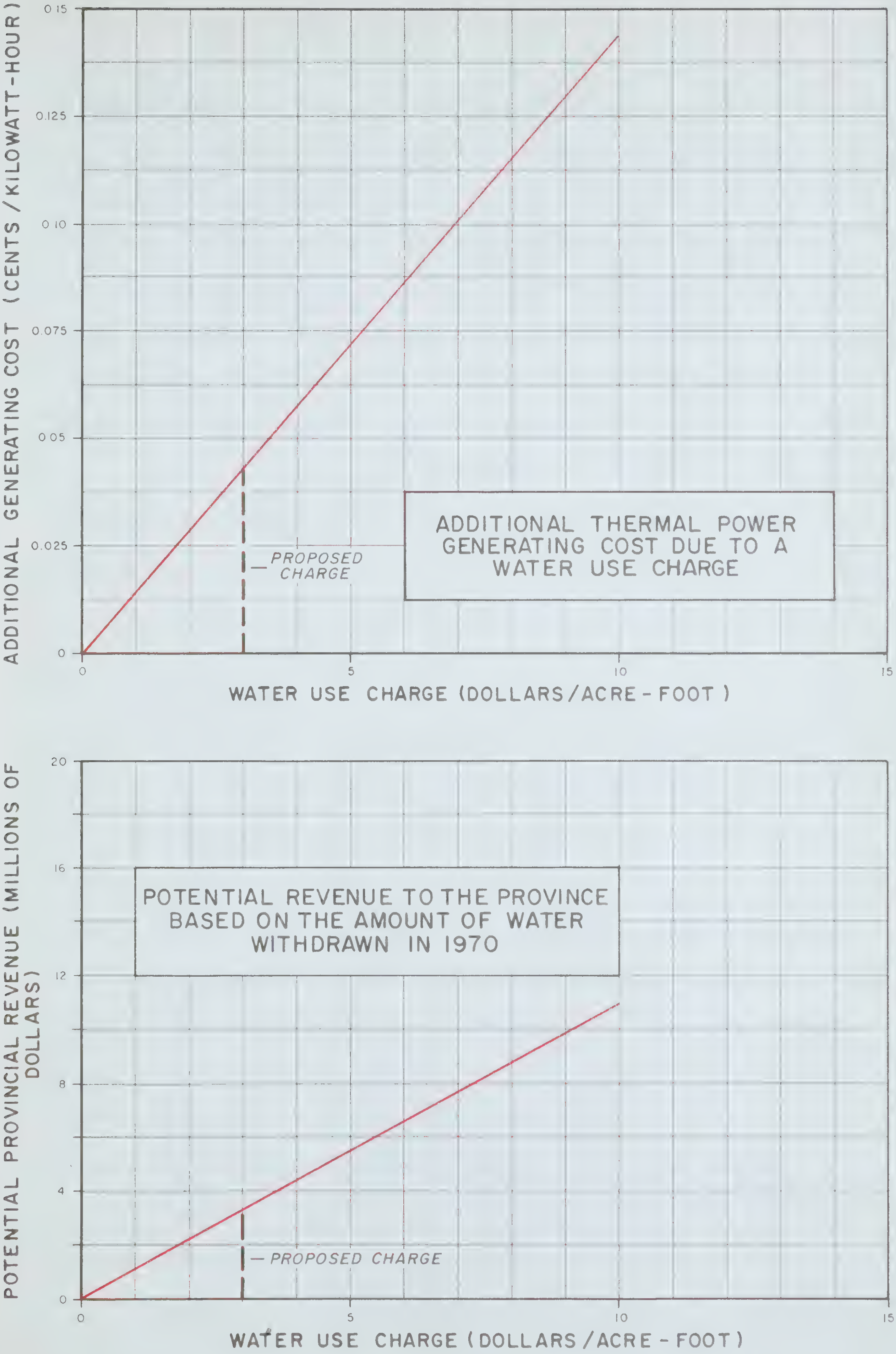
FIGURE 6

relationship between water used and power produced. Water use charges for hydro-electric generation are normally related directly to output or capacity, with some adjustment for the proportion of power used for peaking purpose. Figure 6 has been prepared to indicate the additional production cost associated with a charge on this basis. A charge of $3 per horsepower year is equivalent to an additional cost of approximately 0.045¢/Killowatt hour.

c) Additional generation cost - thermal generating plants. The additional cost of power generation relative to a range of water use charges for thermal plants is shown on Figure 7. A charge of $3 per acre-foot is estimated to increase production costs by approximately 0.045¢/Kwh.

d) Effect related to consumer power rate. It is pertinent to note that the majority of power produced in Alberta is consumed in Alberta. It would be expected that increased cost due to imposition of water use charges would be borne by the Alberta consumers and producers. The current price paid by the domestic and industrial consumer in Alberta for electricity is in the range of 1.50¢/Kwh. to 1.75¢/Kwh.
The additional generating cost from the proposed charges would be equivalent to approx. 3 percent of the current consumer price for electricity.

e) Potential revenue to the province. The potential revenue related to water use charges for hydro-electric and thermal power generation based on recent levels of production are shown on Figure 6 and 7 respectively. A charge of $3 per acre-foot for water used in thermal power plants and of $3 per horsepower year for hydro-electric generation would yield approximately $4 million based on 1970 values of production.



EFFECT OF APPLYING A WATER USE CHARGE TO THERMAL POWER GENERATION

FIGURE 7

Effect of Water Use Charges Related to Irrigation

a) General. It is proposed that charges for water used for irrigation be calculated on the basis of the sliding scale shown in Figure 2. Charges would be applied to the Irrigation Districts and be based on the annual gross diversion into the district. The first acre-foot of water per irrigated acre of the district would be provided without charge. Additional water diverted would be subject to charges based on the sliding scale.

In order to assess the implications of a water use charge with respect to irrigation, the crop requirements for water and corresponding yield and returns per acre have been reviewed.

Table 10 shows the estimated diversion into the irrigation district required for optimum irrigation of a number of crops. Average water requirements, and precipitation data for the irrigated areas of the province was used in preparing this Table. The diversion is assessed to be twice the volume necessary at the farm for irrigation, that is an overall efficiency of 50 percent has been assumed.

b) Additional crop production costs due to a water use charge. Table 11 has been prepared to indicate the additional production cost per irrigated acre due to the proposed water use charge. This additional cost has been expressed as a percentage of recent product selling price to provide a basis for comparison. Generally the additional cost represents approximately one percent of the selling price. However, for alfalfa, the increase approaches 7 percent due to the much higher water requirement for this crop.

TABLE 10. CROP WATER REQUIREMENTS IN SOUTHERN ALBERTA

Crop	Total Water Requirement (Inches per Year)	Moisture Deficit to be Applied by Irrigation		Required Diversion into Irrigation District Assuming 50% Efficiency Acre-Ft. per Acre
		Inches Per Year	Acre-Ft. Per Acre	
Wheat	15.5	9.0	0.75	1.50
Barley	12.5	6.4	0.53	1.06
Sugar Beets	24.6	16.2	1.35	2.70
Potatoes	17.8	10.6	0.88	1.76
Peas (proc.)	12.9	6.4	0.54	1.08
Beans	20.0	13.0	1.08	2.16
Corn (proc.)	19.2	12.0	1.00	2.00
Alfalfa	31.4	22.7	1.89	3.78

Note: Water requirements and moisture deficits are averages for the Irrigation Districts. Moisture deficit is the difference between the crop water requirement and the useful precipitation during the growing season.

TABLE 11. INCREASED IRRIGATION COST FOR VARIOUS CROPS DUE TO THE PROPOSED SCALE OF WATER USE CHARGES

Crop	1971 Selling Price	Production per acre	Required Diversion into Irrigation District Assuming 50% Efficiency Acre Feet/Acre	Cost of Water Per Acre of Land $ per Acre	Cost of Water As a Percentage of Selling Price of Crop
Wheat	$ 1.35/bu.	45 bu.	1.50	0.50	0.83%
Barley	$ 0.83/bu.	60 bu.	1.06	0.06	0.12%
Oats	$ 0.40/bu.	65 bu.	1.32	0.32	1.23%
Sugar Beets	$15.71/ton	16.27 tons	2.70	2.32	0.91%
Potatoes	$29.00/ton	10 tons	1.76	0.76	0.26%
Peas (Processing)	$91.78/ton	1.8 tons	1.08	0.08	0.03%
Beans (Processing)	$102.92/ton	2.5 tons	2.16	1.36	0.54%
Corn (Processing)	$27.38/ton	4.9 tons	2.18	1.36	1.01%
Corn(Silage)	$ 8.50/ton	14.5 tons	2.00	1.00	0.81%
Alfalfa	$23.00/ton	3.5 tons	3.78	5.52	6.86%

NOTE: Production and water requirements are averages for the Irrigation Districts. The figures for alfalfa reflect the fact that in some areas three cuttings are possible while in other areas only two cuttings are obtained.

Based on reported 1969 and 1971 areas of various crops, the potential additional costs from irrigation water use charges have been calculated for a number of Irrigation Districts, and shown in Table 12. For comparison purposes, the charges currently levied by the districts against the farmers for operation and maintenance of the district's facilities are also indicated in Table 12. It is noted that the total cost per acre for each district would be reasonably uniform from year to year although the crop pattern changes significantly. The large proportion of alfalfa grown in the Mountain View, Leavitt, Aetna Districts is the reason for the high charge applied to these districts.

c). Potential revenue to the province. Based on 1969 crop distribution and average water requirements the potential total revenue to the province from the Irrigation Districts is summarized in Table 13. Almost 82 percent of the total would be from alfalfa production. The average charge for all crops would be approximately $2.43 per acre. More detailed information relating to potential district costs is included in Appendix C.

The cost based on the proposed sliding scale for irrigating alfalfa are recognized to be high compared with other irrigated crops. It may be desirable in the case of alfalfa to provide a certain amount of water without charge in addition to the basic 12-inches. The implications of providing a total of 36-inches of water without charge for alfalfa irrigation are discussed in Appendix D.

Effect of Water Use Charge Related to the Consumer in Alberta

The direct effect is dependant, among other factors, on the portion of additional costs resulting from the charges which are passed on to the consumer in the form of higher prices.

The effect of the water use charges on consumer prices of power, manufactured goods and other products will be regulated. Government policy will ensure that the water use charges are not used to justify consumer cost increases in excess of those actually resulting from the imposition of the charge

TABLE 12. POTENTIAL WATER USE CHARGES COMPARED TO EXISTING OPERATION & MAINTENANCE COSTS FOR A NUMBER OF IRRIGATION DISTRICTS

Irrigation District	Charge for Operation & Maintenance Assessed by District in 1972 ($/acre)	Charge for Water Based on Crop Distribution	
		1969 $/acre	1971 $/acre
Eastern	2.70	2.80	2.46
Taber	3.25	2.20	2.33
Mountain View, Levitt & Aetna	1.44 (1971)	4.10	4.10

Note: 1. Charges for operation and maintenance of District Facilities are paid by the farmers to the District. This is not a charge by the Provincial Government.

2. The proposed water use charge would be levied irrespective of operation and maintenance charges levied by the Districts.

TABLE 13. TOTAL POTENTIAL REVENUE FROM THE IRRIGATION DISTRICTS BASED ON THE PROPOSED SCALE OF WATER USE CHARGES AND 1969 IRRIGATED AREAS AND CROP DISTRIBUTION

Crop	Irrigated Area in 1969 Acres	Cost of Water Per Acre of Irrigated Land $/acre	Potential Revenue $
Wheat	258,989	0.50	129,495
Barley	3,903	0.06	220
Sugar Beets	31,970	2.32	74,170
Potatoes	21,080	0.76	16,020
Peas & Veg.	23,443	0.64	15,000
Corn (Processing)	5,536	1.36	7,530
Alfalfa	193,432	5.52	1,067,745
TOTAL	538,142	-	1,310,180

As there is no charge against domestic water use the major additional costs accruing to the consumer would be for electricity and food.

Effect of Water Use Charge Related to Producer in Alberta

The effect on the producer related to the magnitude of the additional cost and the portion borne by himself compared to the portion which may be passed to the buyer of his products. This will vary with sector and likely from producer to producer within a sector. The additional production costs related to product value are summarized in Table 13(a) for the major categories of water users.

In general terms, the potential effect on the industrial sector of charges in the order of $10 per acre-foot is not estimated to be significant.

The power industry is more sensitive to the effect of potential water use charges due to the large volume of water used and widespread effect of any changes in their rate structure. No information is available on the range of charges which may be absorbed directly by the industry.

Irrigation farming is also very sensitive to the effect of potential water use charges. Generally the prices for products are established by market conditions which extend outside of Alberta. It is likely that additional costs due to a water use charge would generally have to be absorbed by the irrigation farmers of Alberta.

Total Potential Revenues

Table 14 summarizes the total gross revenues which would result from the proposed scale of charges and the 1970 level of water use for the major categories.

TABLE 13(a) - SUMMARY OF POTENTIAL INCREASED PRODUCTION COSTS DUE TO THE PROPOSED WATER USE CHARGES

Major Category of Water User	Additional Production Cost as a Percentage of Product Selling Price
*General Industrial and Commercial	Generally less than 1%. Majority of Food Items less than 0.1%.
Electricity Generation	Approximately 3%
Irrigation	Generally less than 1%

*Information for specific industries is presented in Table 8.

TABLE 14 - ESTIMATED TOTAL REVENUE FROM THE PROPOSED SCALE OF WATER USE CHARGES BASED ON 1970 LEVEL OF WATER USE

Major Category of Use	Proposed Water Use Charge	Revenue ($ Million)
*General Industrial and Commercial	$10/acre-ft.	3.0
Thermal Electric Plants	$3/acre-ft.	3.2
**Hydro-Electric Plants	$3/hp Year	0.6
Irrigation	According to Sliding Scale	1.3
Total		8.1

* Includes $1 million from oil field flooding, charged $20/acre-foot.

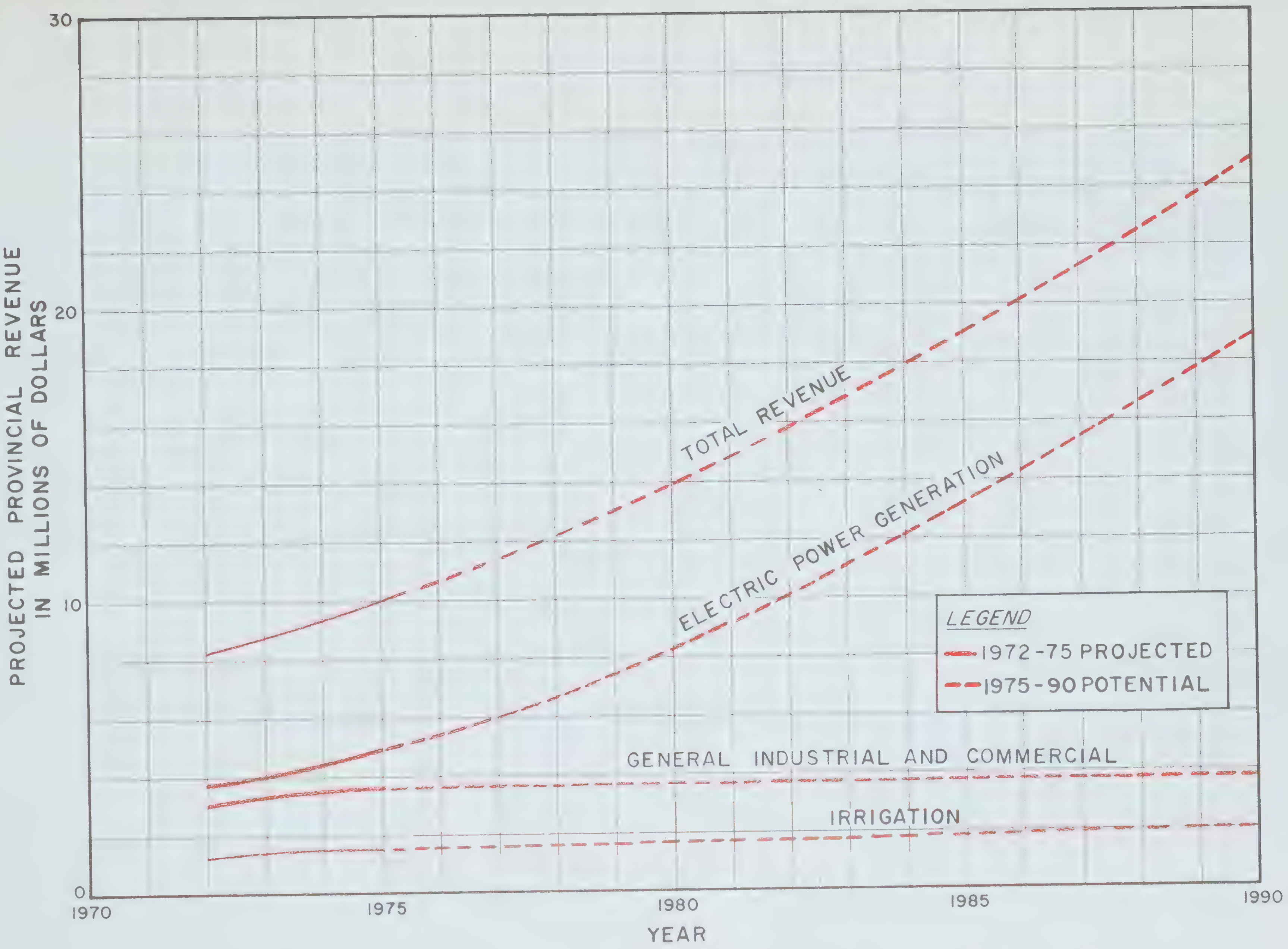
** The proposed charge of $3/hp year would replace the existing charge of approximately $1/hp year.

The potential gross revenue per year based on potential water requirements to 1990 is presented in Table 15 and shown on Figure 8. This incorporates a number of very broad assumptions which have been discussed earlier. It is at best a broad indication of potential only.

TABLE 15. POTENTIAL REVENUE BASED ON PROJECTIONS OF WATER REQUIREMENTS TO 1990

Category	Potential Revenue (Millions)		
	1972	1975	1990
General Industrial	3.0	3.6	*3.8
Electricity Generation	3.8	4.9	19.0
Irrigation	1.3	1.5	2.0
TOTAL	8.1	10.0	24.8

*Reflects projected decreased oilfield flooding in period 1980-1990



POTENTIAL REVENUE TO THE PROVINCE FROM
THE PROPOSED SCALE OF WATER USE CHARGES

FIGURE 8

CONCLUSIONS

1. A general charge for the use of water as a resource, separate from any charges associated with specific development costs, has the potential to reflect to society in general the value of its resource.

2. A charge for water as a natural resource is imposed in a number of Canadian provinces and American states.

3. The bulk of revenue raised in Canada from water use charges is from charges applied to the hydroelectric power generation industry.

4. Approximately 80 percent of the water presently used in Alberta is for the generation of hydroelectric power. Approximately 1 million acre-feet of water is withdrawn for irrigation and 1/4 million acre-feet is used by industry. Excluding the power generating sector 98 percent of water used in industry is used by 25 percent of the users.

5. A rate structure for water use charges should be equitable, acceptable,and practical.

6. The power generating industry and irrigation enterprises would be particularly sensitive to the scale of water use charges adopted.

7. The proposed rate structure would result in increased production cost for general industrial users of less than 1 percent of current product value. An additional cost in the order of 3 percent would be imposed on the power generating industry. Additional irrigation costs would be generally in the order of 1 percent of current product value.

8. Application of the proposed charges to the 1970 level of water use would generate revenue of approximately $8 million. Approximately 50% of this would be levied against the power generating industry.

RECOMMENDATIONS

1. Water use charges should be applied against licenced water withdrawals.

2. Water use for domestic purposes should be exempted from charges.

3. Water use for public and general recreational purposes should be exempted from charges.

4. Provision should be made for a periodic review, by the provincial government, of all aspects related to the Water Use Charges. In particular, it is recommended that review of the Scale of Charges be carried out at five year intervals.

REFERENCES

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APPENDIX A

EXISTING WATER USE CHARGES

The discussion and tables presented in the chapter on EXISTING WATER USE CHARGES are based in large part on the response to a questionnaire distributed to a number of major water resource agencies. User charges are determined in a variety of ways by these agencies, and an effort has been made to standardize the information as presented herein. The diversity of information necessitates some descriptive interpretation within tables 16, 17, and 18.

Table 16

CURRENT PROVINCIAL WATER USE CHARGES IN CANADA

Type of Charge	Item	Province	Description of Charge	Rate $/hp-year output
For Use of Water as a Natural Resource	1. Hydro-electric Power Generation (Recurring Charge)	Alberta	- Sliding Scale cost based on annual load factors from 100% to 40% and under	1.00 to 1.30
		British Columbia	- less than or equal to the sum of 0.30 hp of installed or estimated capacity plus 0.52 hp-year output (reduced by upto 60% for small power developments).	
			- individually determined charges for storage used for out of province generation, i.e. Columbia River Treaty	
			- annual revenue $3.4 million	
		Manitoba	- greater value of $0.50/hp. installed capacity	Or 1.25
		Newfoundland	- $0.75/hp. of undeveloped capacity	Plus 3.75
		Nova Scotia	- first 5 years, based on installed capacity	0.125
			- thereafter, based on installed capacity	0.25
		Ontario	- Ontario Hydro: X = ratio of Consumer Price Index (CPI) of current year/1957 CPI	1.35 (X)
			- private companies: Y = ratio of CPI of current year/1962 CPI	1.85 (Y)
		Quebec	- Hydro Quebec	3.26
			- private companies	3.00
			+ additional power from storage reservoirs	3.00
			+ Progress of Education Tax (sites of less than 10,000 hp. excluded)	0.98
		Saskatchewan	- annual rental	1.25
			- in non-operating plants (based on installed capacity)	0.25
		North West Territories	- sliding scale, based on load factor	1.00 to 1.30
		Yukon	- sliding scale, based on load factor	0.75 to 1.30
		New Brunswick) Prince Edward) Island)	- No Charge	Nil
				Rate $/Acre-foot
	2. Diversion or Storage (Recurring Charge)	Alberta	- Water Resources Act provides for charges	Nil
		British Columbia	- Domestic: first 1.34 acre-ft.	3.72
			- additional use	1.49
			- wash water: canners, fish reduction plants	0.74
			- bottled mineral water: first 0.67 acre-ft.	29.74
			- additional use	7.44
			- mineral water baths	3.72
			- storage	0.001 to 0.0004
			- irrigation	0.10
			- industrial	0.37
			- annual revenue $0.6 million	
		Newfoundland	- industrial or mining in licenced area	0.05

continued

Type of Charge	Item	Province	Description of Charge	Rate $/Acre-foot
		Nova Scotia	- charges to sawmills, hatcheries, industries	Arbitrary
		Quebec	- Municipalities: holding ponds for logs or water supply other organizations	0.01 0.033
		Saskatchewan	- Industrial users drawing more than 15 acre-ft./year pay as follows	
			- S. Saskatchewan and Qu'Appelle systems	15.00
			- thermal plant cooling water	5.00
			- water with total dissolved solids over 3000 ppm	1.00
			- water from Blairmore formation and lower	Nil
			- water from other sources	3.00
		New Brunswick) Ontario) Prince Edward Island) Yukon) North West Territories)	- No Charge	Nil
Licence	3. Issuance Fee (Non-Recurring Charge)	Alberta	- Sliding Scale from 10 to 20,000 acre-ft.	0.10 to 0.01
			- additional	0.005
		British Columbia	- usually 1/2 to twice the annual fee	
		Saskatchewan	- Surface Water: sliding scale from 10 to 10,000 acre-ft. - expected new scale from 100 to 20,000 acre-ft. (Min. $10.00) - additional by Order-in-Council	0.10 to 0.01 0.10 to 0.01
			- Groundwater: flat rate scale from $10 to $100 for upto 10,000 acre-ft. - additional by Order-in-Council	0.10 to o.01
		Manitoba) New Brunswick) Newfoundland) Labrador) Nova Scotia) Ontario) North West Territories) Yukon) Prince Edward Island) Quebec)	- No Charge	Nil
Associated with Supply or Development	4. Water Furnished by licensee (Recurring Charge)	Alberta	- Irrigation: charges related to acreage, not volume used or diverted - average charge 1950 - 1967 - range of rates 1965 - 1966	 1.12 0.05 to 4.10
			Municipalities: rates generally decrease with increasing population-range	100 to 270
			- Domestic: Edmonton and Calgary 1966 - 1967 - computed on gross pumpage, domestic costs can be expected to be higher	200
			- Industrial: Edmonton and Calgary 1966 - 1967 - users of over 5000 gallons/month	60
		British Columbia	- Residential: metered Vancouver range - unmetered range	80 to 100 34 to 54
			- Industrial: Vancouver range	56 to 100
			- Irrigation: Okanagan Districts, range at average depth of 2.5 feet/year - 75% are pressurized	7 to 14
			- Domestic: Irrigation districts range $60 to $170 year, average $72/year	
		Saskatchewan	- Irrigation: $4.80/acre Initial non-recurring charge	0
			- Industrial: Potash - present charge - projected 1985 charge	160 87
			- Municipal: Town of Leningan range, not including distribution charge - Regina, MooseJaw, not including distribution charge	100 - 119 35

continued

Type of Charge	Item	Province	Description of Charge	Rate $/acre-foot
		Other Provinces	- Industrial)	50 to 100
			- Domestic) Approximate Averages	100
			- Irrigation)	10

The sources of information for Items 1, 2, and 3 are:

"A Survey of Governmental Charges for the Use of Water as a Resource", September, 1969.
Canadian Council of Resource Ministers.

ECO/LOG, Canadian Pollution Legislation, Chinook Chemicals Corporation, Toronto.

Table 17

CURRENT WATER USE CHARGES IN THE UNITED STATES

State	Hydro Power	Irrigation	Domestic	Industrial	Recreation
New Jersey	no information	$.13/ac.ft. for every ac.ft. in excess of .37 ac.ft./day	$.27/ac.ft. to $2.70/ac.ft. according to available stream flow.	$2.70/ac.ft. in excess of .36 ac.ft./day	no information
	No information on license fees.				
New York	Flat rate rental charges exist for hydro. Rental rate ranges from $32,500/ annum to $1,100,000/ annum	$.25/inch diameter siphon per month	Municipal water charge is under the authority of each County. It is questionable whether this charge is a water use charge or a water supply recovery cost	no information	no charge
	New York also has water license charges.				
Pennsylvania	no charge	no charge	½ of 1% of the gross profit that results from sale of water by the supplier if reservoir is on State land.	no charge	no charge
Alabama	no charge	no charge	no charge	$29.95/ac.ft.	no charge
Rhode Island	Under state legislation the Water Resources Board has authority to purchase and sell water. From the information available there is no indication that this has ever been done.				
Oregon, Iowa, Washington, Oklahoma, Nevada	No water use charges in these states however they do have nominal license fee charges for most uses of water.				
California	No water use charge in this state however under the California State Water Project. 31 public agencies will enter into contracts with the state to provide water service for many uses including municipal, agricultural and industrial. These agencies will pay two charges: one a unit charge for the water development service and the other a charge for their share of project capital and annual operating and maintenance expense. Cost associated with uses such as recreation, fish, wildlife and flood control are paid by the State and Federal Government.				
W. Virginia, Utah, N. Dakota, New Hampshire, Connecticut, Montana, Illinois, Virginia, Florida, Massachussetts, Hawaii, New Mexico, Ohio, Delaware, Puerto Rico, Kansas, Wyoming and Tennessee, Maine, Arizona	From the information available these states do not levy any water use charge or water license charge.				

Notes: 1. Information obtained from 31 States

2. Charges listed are "royalty" charges and are not designed to recover development costs.

OTHER COUNTRIES

TABLE NO. 18

CURRENT WATER USE CHARGES IN OTHER PARTS OF THE WORLD

(water as a natural resource)

Country (9 Countries Examined)	Hydro Power	Irrigation	Domestic	Industrial	Recreation
England	Water charges in England are not under national control but several authorities have the jurisdiction to levy charges.				
eg. - Lee Conservancy Catchment Board	-	$.93-$5.60/ac.ft.	$.37-$2.24/ac.ft.	$.37-$2.24/ac.ft.	-
	The above charges are based on balancing a water resource account. Each abstraction of water is charged the same, but the charge is multiplied by a factor which is dependent upon usage, source and the season of the year.				
Switzerland	No national control on water charges. Jurisdiction to levy charges lies within the Provinces.				
Finland	Generally no charge for water use as every landowner owns the water rights on his land. Should someone else wish to divert water he may go to the Water Court for a ruling.				
Iceland	Hydro development must obtain water right	No water use charge but water supply costs are laid down by law according to the real estate valuation of one's property.			
Denmark, Austria, Sweden, Belgium and India	From the information available these countries do not levy any water use charge or water license charge.				

APPENDIX B

WATER USE IN ALBERTA

In 1967, an Industrial Water Use Questionnaire was distributed to companies in Alberta. From these questionnaires, an attempt was made to determine the water requirements for major industrial products in Alberta. These are presented in Table 19. For products where more than one company reported, a range of water use is shown.

In 1967, of the 13,430,000 acre-feet of water used, 13,282,000 acre-feet or 99% was through private systems. The division between municipal and private systems is presented in Table 20.

In 1967 almost all of the water used was from surface sources. An estimated 13,393,000 acre-feet or 99.8% of all water used was from surface sources with only 38,000 acre-feet of groundwater used.

Estimates of 1970 levels of water use together with projections for 1975 and estimates of the potential requirements for 1990 are presented in Table 5 in the text of this report.

Much of the information presented in this table was taken from reference 6. However, in certain cases it was necessary to make a number of assumptions in order to extend the projection to 1990. The assumption included:

i) Introduction of water use charges will not have a significant effect on the total volume of water requirements as projected in reference 6.

ii) The rate of increase of general industrial water requirements will continue during the period 1975-1990 at the rate projected for 1970-1975.

iii) Total power requirements will increase approximately 12 percent per year. Approximately 10 percent of the increase will be supplied by thermal generating plants.

iv) The majority of the irrigable areas in the Irrigation District will have been serviced by 1990.

TABLE 19

TYPICAL WATER REQUIREMENTS FOR MANUFACTURING AND PROCESSING IN ALBERTA

	UNIT	WATER REQUIREMENT FOR PROCESSING
Bread	gal/loaf	0.11-0.49
Milk - Evaporated - Skim milk powder	gal/lb. gal/lb.	0.156 0.67
Cheese	gal/lb.	3.0
Butter	gal/lb.	0.25
Vegetables	gal/lb.	2.5
Meat	gal/lb.	1.05-28.5
Beer	gal/gal.	12.6-23.0
Soft Drinks	gal/gal.	1.75-11.0
Natural Gas.	gal/MCF	.0037-.50
Sulphur	gal/ton	6.7-160
Oil (Production)	gal/barrel	32-100
Fertilizer	gal/ton	500
Kraft Paper	gal/ton	40
Petroleum Products	gal/barrel	1.93-890
Paper	gal/ton	5.2
Ammonia	gal/ton	1900
Explosives	gal/lb.	15

TABLE 20

PROPORTION OF WATER SUPPLIED THROUGH MUNICIPAL AND PRIVATE SUPPLY SYSTEMS

Major Category of Use		Water Used (Acre-Feet)		
		Municipal	Private	Total
Domestic	Municipal, Rural and Stock	92,500	62,600	155,100
Institutional and Public		20,000	-	20,000
General Industrial and Commercial	Dairies	712	119	831
	Beverages	2,218	1,044	3,262
	Meat Packing	15,960	1,262	17,222
	Oil Field Flooding	40	22,099	22,139
	Natural Gas Processing	70	13,638	13,708
	Petroleum Products	269	33,089	33,358
	Chemical and Chemical Prod.	920	71,819	72,739
	Other	14,631	28,946	43,577
Total of General Industrial and Commercial		24,820	172,016	206,836
Thermal Electric Plants	Thermal	680	747,014	747,694
Hydro-Electric Plants	Hydro	-	11,128,000	11,128,000
Irrigation		-	1,172,480	1,172,480
TOTAL		148,000 1%	13,282,110 99%	13,430,110

Note: * Average of the past several years.

TABLE 21

VOLUME OF WATER FROM SURFACE AND GROUNDWATER SOURCES (1967)

Major Category of Use		Source of Water (Acre-Feet)		
		Surface	Ground-water	% Surface water
Domestic	Municipal, Rural and Stock	136,000	19,300	88
Institutional and and Public		20,000	0	100
General Industrial and Commercial	Dairies	696	135	84
	Beverages	2,350	912	72
	Meat Packing	15,500	1,722	90
	Oil Field Flooding	15,800	6,339	72
	Natural Gas Processing	12,300	1,408	90
	Petroleum Products	33,358	0	100
	Chemical and Chemical Prod.	71,000	1,739	98
	Other	37,267	6,310	85
Total of General Industrial and Commercial		188,271	18,565	91
Thermal Electric Plants	Thermal	747,694	-	100
Hydro-Electric Plants	Hydro	11,128,000	-	100
Irrigation		1,172,480	0	100
TOTAL		13,392,745	37,865	

APPENDIX C

TOTAL WATER USE CHARGES FOR SELECTED IRRIGATION DISTRICTS

Tables 22, 23, and 24 include the total charge for water use which would have been assessed against a number of Irrigation Districts for the crop distribution in recent years, calculated water requirements and the proposed scale of charges.

TABLE 22. TOTAL WATER USE CHARGE FOR EASTERN IRRIGATION DISTRICT BASED ON CROP DISTRIBUTION AND PROPOSED SCALE OF CHARGES

Crop	Cost Per Acre for Water $/acre	1969 Irrigation Area (acres)	District Water Use Charge $	1971 Irrigation Areas (acres)	District Water Use Charge $
Alfalfa	5.52	90,811	501,276	50,225	277,242
Barley	0.06	3,458	207	43,722	2,623
Wheat	0.50	84,076	42,038	15,571	7,785
Sugar Beets	2.32	684	1,586	50	116
Peas & Veg.	0.64	9,127	5,841		
Potatoes	0.76	9,469	7,196	5,003	3,802
Corn	1.00	623	623	135	135
Oats	0.32			12,803	4,097
Grass (Seed)	5.52			4,268	23,560
Pasture	5.52			28,778	158,854
Flax	0.50			3,938	1,969
Rye	0.06			478	29
Silage	0.06			4,826	290
Vegetable	0.64			688	440
Hay	5.52			535	2,953
Greenfeed	0.32			5,734	1,835
Miscellaneous	-			20,293	
TOTAL		198,248	558,767	197,047	485,730

TABLE 23. TOTAL WATER CHARGE FOR TABER IRRIGATION DISTRICT BASED ON CROP DISTRIBUTION AND PROPOSED SCALE OF CHARGES

Crop	Cost Per Acre for Water $/acre	1969 Irrig. Area (acres)	District Water Use Charge $	1971 Irrig. Areas (acres)	District Water Use Charge $
Alfalfa	5.52	11,745	64,832	8,000	44,160
Wheat	0.50	19,915	9,957	6,000	3,000
Sugar Beets	2,32	9,028	20,945	14,000	32,480
Peas & Veg.	0.64	1,233	789		
Potatoes	0.76	1,171	892	4,000	3,040
Corn	1.36	2,888	3,928		
Oats	0.32			6,000	1,920
Barley	0.06			2,000	120
Peas	0.08			3,000	240
Corn (Silage)	1.00			1,000	1,000
Corn (Sweet)	1.36			3,000	4,080
Pasture	5.52			9,000	49,680
TOTAL		45,980	101,343	60,000	139,720

TABLE 24. TOTAL WATER CHARGE FOR MOUNTAIN VIEW, LEVITT & AETNA IRRIGATION DISTRICTS BASED ON CROP DISTRIBUTION & PROPOSED SCALE OF CHARGES

Crop	Cost Per Acre for Water $/acre	1969 Irrig. Area (acres)	District Water Use Charge $	1970 Irrig. Areas (acres)	District Water Use Charge $
Alfalfa	5.52	7,053	38,,933	10,188	56,238
Wheat	0.50	2,783	1,391	4,019	2,010
TOTAL		9,836	40,324	14,207	58,248

APPENDIX D

ALTERNATIVE SCALE OF CHARGES FOR IRRIGATION

Table 11 in the text of the report indicates the additional cost due to the proposed scale of water use charges for a number of crops. While generally the increased costs represent less than one percent of the value of the crop, in the case of alfalfa the increase is in the order of 7 percent. This is due to the fact that irrigated alfalfa has a high water requirement and the proposed scale of charges increases rapidly for water diversion of more than 3 acre-ft./acre.

From Table 13 in the text it is noted that while alfalfa acreage represented approximately 36 percent of the total irrigated acreage in 1969, the revenue from water use charges from this crop would have represented 80% of the total from irrigation.

The scale of charges was designed to impose very low charges for normal estimated crop requirements but to penalize the extremely inefficient user. The additional burden placed on the alfalfa growers would therefore appear inequitable. One alternative solution to the problem would be to increase the free water from the basic 12 inches per irrigated acre to 24 inches or 36 inches per irrigated acre for alfalfa growers. The effect on production cost is illustrated in Table 25.

TABLE 25 - Increased Production Cost of Alfalfa Compared to alternative Water Use Charge Scales

Water Required to be Diverted into Irrigation District (acre-ft./acre)	Value of Alfalfa $/acre	Additional Cost per Acre for Water Use Charge					
		12" Free Water		24" Free Water		36" Free Water	
		$	% of Value	$	% of Value	$	% of Value
3.78	80.50	5.50	7	2.50	3	0.70	1

However, adoption of such scale of charges would significantly reduce the total revenues to the province from a water use charge applied to irrigation. Based on 1969 acreages of crops the potential revenues from irrigation assuming the scale of charges proposed in this report are compared in Table 26 with that which would result from allowing further free water to alfalfa growers.

TABLE 26 - POTENTIAL REVENUE FROM IRRIGATION FOR ALTERNATIVE WATER USE CHARGE SCALES

	Potential Revenue - 1969 Areas		
	Charges A	Charges B	Charges C
Alfalfa	1.07	0.49	0.14
Total for Other Irrigated Crops	0.24	0.24	0.24
Total	$1.31 million	$0.73 million	$0.38 million

Charge A - 12" free water

Charge B - 24" free water to alfalfa growers

Charge C - 36" free water to alfalfa growers